



# **INTERNAL STRUCTURE OF EARTH**

Parcham Classes

## WHAT SHOULD YOU UNDERSTAND ABOUT THE INTERIOR OF THE EARTH?

- It is not possible to know about the earth's interior by direct observations because of the huge size and the changing nature of its interior composition.
- It is an almost impossible distance for the humans to reach till the centre of the earth (The earth's radius is 6,370 km).
- Through mining and drilling operations we have been able to observe the earth's interior directly only up to a depth of few kilometers.

## SOURCES OF INFORMATION ABOUT THE INTERIOR OF THE EARTH

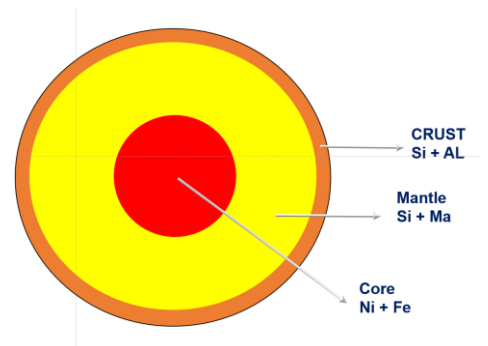
- **Direct Sources:**
- Rocks from mining area
- Volcanic eruptions

## INDIRECT SOURCE

- By analyzing the rate of change of temperature and pressure from the surface towards the interior.
- Meteors, as they belong to the same type of materials earth is made of.
- Gravitation, which is greater near poles and less at the equator.
- Magnetic sources.
- Seismic Waves: the shadow zones of body waves (Primary and secondary waves) give us information about the state of materials in the interior.

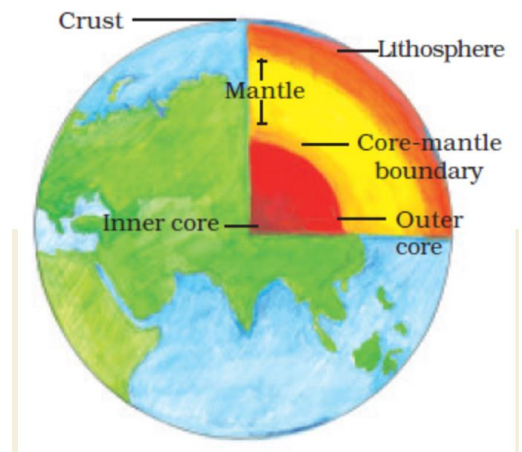
## EARTH'S INTERIOR

- Based on the data obtained by seismic waves the Earth's interior can be categorized into three zones:
- The Crust :The outer most layer ( Si + Al ).
- The Mantle :The middle layer that is fluid (Si- Ma)
- The Core :The innermost layer composed of (Ni + Fe).





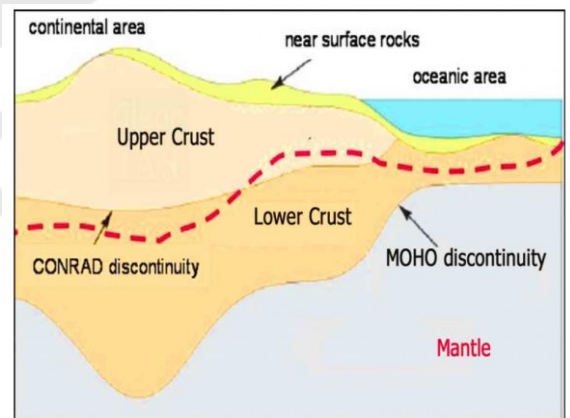
- The lithosphere is the upper 80 Kilometers layer composed of both the crust and part of the upper mantle
- Earth's mantle is a rocky shell about 2,890 Kms thick that constitutes about 84 percent of Earth's volume.
- The outer core is in the liquid state.
- The inner core is in solid-state.



## CRUST

- The crust is the outermost solid part of the earth.
- It is fragile.
- The thickness of the crust varies under the oceanic and continental areas.
- Oceanic crust is thinner as compared to the continental crust.
- The continental crust is thicker in the areas of major mountain systems.
- The crust is made up of heavier rocks having a density of 3 g/cm<sup>3</sup>.
- The kind of rock seen in the oceanic crust is basalt.
- The mean density of material in the oceanic crust is 2.7 g/cm<sup>3</sup>.

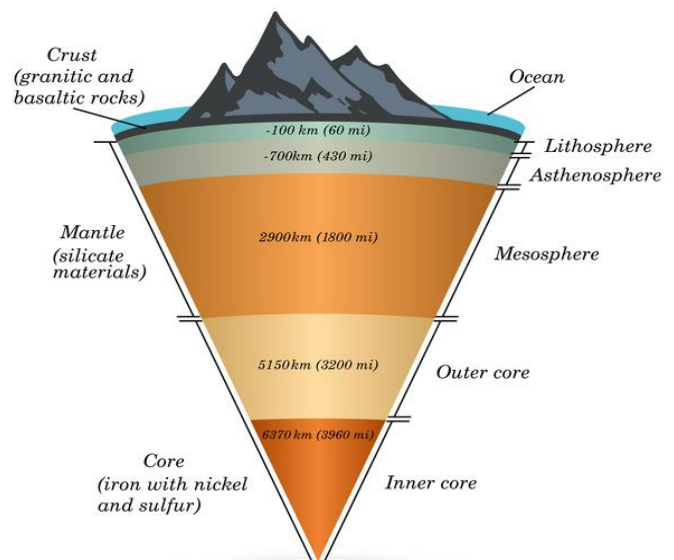
- Silica (Si) and Aluminium (Al) are major constituent minerals. Hence it is often termed as SIAL. Also, sometimes SIAL is used to refer to the Lithosphere.
- It is the outermost solid part of the earth, normally about 8-40 kms thick.
- Nearly 1% of the earth's volume and 0.5% of earth's mass are made of the crust.
- The discontinuity between the hydrosphere and crust is termed as the Conrad Discontinuity.



# MANTLE

- The discontinuity between the crust and mantle is called as the Mohorovich Discontinuity or Moho discontinuity.
  - The mantle is about 2900kms in thickness.
  - Nearly 84% of the earth's volume and 67% of the earth's mass is occupied by the mantle.
  - The major constituent elements of the mantle are Silicon and Magnesium and hence it is also termed as SIMA.
  - The density of the layer is higher than the crust and varies from 3.3 – 5.4g/cm<sup>3</sup>.
  - The uppermost solid part of the mantle and the entire crust called the Lithosphere.
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- The temperatures increase with depths.
  - The temperature is lowest near the crust and increases with depth.
  - The highest temperatures are found near the mantle material as it is in contact with the heat-producing core.
  - This steady increase of temperature with depth is known as the geothermal gradient.
  - Rocks in the upper mantle are cool and brittle, while rocks in the lower mantle are hot and soft (but not molten).
  - Rocks in the upper mantle are brittle enough to break under stress and produce earthquakes.
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- The portion of the mantle which is just below the lithosphere and asthenosphere, but above the core is called as Mesosphere.

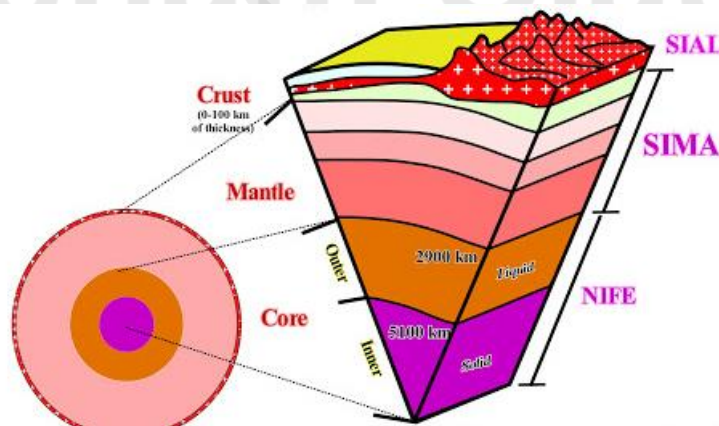
## EARTH STRUCTURE



# CORE

- It is the innermost layer surrounding the earth's centre.
  - The core is separated from the mantle by Guttenberg's Discontinuity.
  - It is composed mainly of iron (Fe) and nickel (Ni) and hence it is also called as NIFE.
  - The core constitutes nearly 15% of earth's volume and 32.5% of earth's mass.
  - The core is the densest layer of the earth with its density ranges between 9.5-14.5g/cm<sup>3</sup>.
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- The Core consists of two sub-layers: the inner core and the outer core.
  - The inner core is in solid state and the outer core is in the liquid state (or semi-liquid).
  - the radioactive material which is present inside it release heat as they break down into more stable substances.
  - The outer core is a liquid because the high temperatures melt the iron-nickel alloy.
  - The inner core is a solid even though its temperature is higher than the outer core because of very high pressure from the weight of rocks lying above it .
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- The discontinuity between the upper core and the lower core is called as Lehmann Discontinuity.
  - Barysphere is sometimes used to refer the core of the earth or sometimes the whole interior.

## Temperature, Pressure and Density of the Earth's Interior



## TEMPERATURE

- A rise in temperature with increase in depth is observed in mines and deep wells.
- These evidence along with molten lava erupted from the earth's interior supports that the temperature increases towards the centre of the earth.
- In the beginning, this rate of increase of temperature is at an average rate of  $10^{\circ}\text{C}$  for every 32m increase in depth.

## PRESSURE

- Just like the temperature, the pressure is also increasing from the surface towards the centre of the earth.
- It is due to the huge weight of the overlying materials like rocks.
- It is estimated that in the deeper portions, the pressure is tremendously high which will be nearly 3 to 4 million times more than the pressure of the atmosphere at sea level.

## DENSITY

- Due to increase in pressure and presence of heavier materials like Nickel and Iron towards the centre, the density of earth's layers also gets on increasing towards the centre.
- The average density of the layers gets on increasing from crust to core and it is nearly  $14.5\text{g/cm}^3$  at the very centre.

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## QUESTION

- Consider the following statements regarding layered structure of earth:

1. Inner Core is the densest layer of earth's interior.
2. Continental crust is less dense than the oceanic crust.

Choose the correct statements?

- a) Only 1
- b) Only 2
- c) Both 1 and 2
- d) None of the above

- Consider the following statements regarding the gravitation force of the earth:

1. Gravitation force is not same at different latitudes on the surface.
2. Gravitational force is greater near the poles and less at the equator.

Choose the incorrect statements?

- a) Only 1
- b) Only 2
- c) Both 1 and 2
- d) None of the above

1. Seismic Activity
2. Volcanoes
3. Gravitational force
4. Earth magnetism
5. Meteors
6. Surface Rocks or Mined Rocks

Which one of the above sources are indirect source of information about the Interior of the Earth?

- a) 1,3,4 and 5
- b) 1, 2,3 and 5
- c) 6 only
- d) All of the above



▪ The oceanic crust consists mainly of \_\_\_\_\_.

1. granitic rocks
2. basaltic rocks
3. ultramafic rocks
4. gabbroic rocks

▪ The continental crust consists mainly of \_\_\_\_\_.

1. granitic rocks
2. basaltic rocks
3. ultramafic rocks
4. gabbroic rocks

▪ The Moho separates:

1. the outer core from the inner core
2. the lithosphere from the asthenosphere
3. the asthenosphere from the Mesosphere
4. the crust from the mantle

question	answer
1	c
2	d
3	a
4	b
5	a
6	d